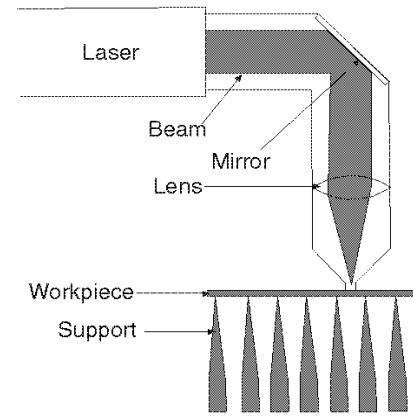


Applied Technology: Laser

Concept

Lasers are beams of monochromatic (all one wavelength) light focused precisely to produce a very intense energy beam. The power density in the beam can be high enough to vaporize, melt, or red-heat virtually any material. Lasers commonly cut, weld, and heat treat materials ranging from wood and plastics to the most heat resistant metals and ceramics. Because laser light beams have no inertia, they can be easily and rapidly controlled in intensity and direction with computer control systems. Thus, laser material processing systems lend themselves especially well to modern digital automation and flexible manufacturing operations.



Credit: EPRI CMP V3,N9, 1986

Applications

- Cutting and Drilling
- Welding
- Heat Treating
- Cleaning and Degreasing
- Engraving
- Biomedical
- Sealing (packaging)

Technologies Replaced

- Mechanical Metal Removal
- Arc and Gas Welding
- Solvent and Abrasive Cleaning
- Induction, Flame, and Plasma Hardening

Wastes Reduced

- Metal Cutting Fluids and Wastewater (machining)
- Scale and Slag (welding)
- Hazardous and VOC Solvents
- Metal Cutting Fluids and Wastewater (machining)
- Scale and Slag (welding)
- Hazardous and VOC Solvents

Potential in Manufacturing

<u>Indust</u>	<u>SIC</u>	<u>Pot</u>	<u>Indust</u>	<u>SIC</u>	<u>Pot</u>	<u>Indust</u>	<u>SIC</u>	<u>Pot</u>	<u>Indust</u>	<u>SIC</u>	<u>Pot</u>	<u>Indust</u>	<u>SIC</u>	<u>Pot</u>
Food	20	LOW	Lumber	24	LOW	Chem	28	LOW	Stone	32	LOW	Elect	36	HI
Tobac	21	LOW	Furn	25	MED	Petrol	29	LOW	Pmetal	33	LOW	Transp	37	HI
Textile	22	LOW	Paper	26	MED	Rubber	30	LOW	MetFab	34	HI	Instr	38	HI
Apparel	23	LOW	Printing	27	LOW	Leather	31	LOW	Mach	35	HI	Misc	39	MED

Credits: : Dr. Philip Schmidt and Dr. F.T. Sparrow;
Unimar Group, Ltd; The Electrification Council; Electric Power Research Institute

Laser *continued*

Technology Advantages

- Fast Cutting and Welding
- High Surface Quality
- Ability to Machine Difficult Materials (e.g. superalloys, ceramics)
- Reduced Material Loss
- Flexibility and Controllability
- Repeatability (non-contact processing)
- Minimal or No Thermal Effects

Technology Disadvantages

- High Capital Cost
- Line-of-Sight Limitation

Typical Costs

Capital Costs

high. 10 times some other cutting and welding systems; 5 times induction heat treatment units. These costs due in part to extensive digital control equipment needed

O & M Costs

application dependent. slightly higher energy for cutting and drilling; 15-30% lower for welding and heat treating. Labor cost usually lower. Maintenance cost comparable

Potential Payback

very application dependent. Generally good for high product lots, high-valued products (requiring high quality), or for operations requiring high flexibility and quick changeover

Installations

Case A - Carbon dioxide laser systems are used by a large auto manufacturer for heat treating the inside of malleable cast iron housings for power steering gears. Because the laser beam can be accurately controlled and directed, only specific areas of the housing wall that are contacted by metal components (so-called “wear tracks”) need be heat treated. The process saves over 10% of the energy associated with induction heat treating on the entire housing inner wall and eliminates the spray quenching required with induction hardening. More importantly, it is faster and requires less labor. Estimated savings of about \$0.11 per part are realized.

Case B - Laser welding systems are used by an appliance manufacturer to weld the corners of hot-rolled steel refrigerator doors. The laser system requires about 16% less electricity than the competing arc welding process, and requires less setup time. Net savings of \$150,000 have been reported on production of 970,000 doors per year.



Major Vendors

Laser

Amada

2025 Firestone Blvd
Buena Park, CA 90621
(714) 739-2111

Cincinnati, Inc.

Box 11111
Cincinnati, OH 45211
(513) 367-7100

Coherent, Inc.

5100 Patrick Henry Drive
Santa Clara, CA 95054
(800) 227-1955

Coherent General, Inc.

1 Picker Road
Sturbridge, Massachusetts 01566
(508) 347-2681

Convergent Energy, Inc

1 Picker Road
Sturbridge, MA 01566
(508) 347-2681

Excel\Control Laser, Inc.

7503 Chancellor Drive
Orlando, FL 32809
(407) 438-2500

Hobart Laser Products

238 Executive Drive
Detroit, MI 48083
(810) 588-8812

Laser Applications, Inc.

6371 North Orange Blossom Trail
Orlando, FL 32810
(407) 290-0336

Lumonics Corporation

6690 Shady Oak Road
Eden Prairie, MN 55344
(612) 941-9530

MC Machinery Systems, Inc.

Laser Division
1500 Michael Drive
Wood Dale, IL 60191
(708) 860-2572

Mazak Nissho-Iwai

140 E. State Parkway
Schaumburg, IL 60173
(708) 882-8777

Radiance Services Company

(cleaning and degreasing)
4405 East West Highway, Suite 512
Bethesda, MD 20814
(301) 654-0228

U.S. Laser Corporation

825 Windham Court North
Wyckoff, NJ 07481
(201) 848-9200

This list of vendors of the indicated technology is not meant to be a complete or comprehensive listing. Mention of any product, process, service, or vendor in this publication is solely for educational purposes and should not be regarded as an endorsement by the authors or publishers.

Index to EPRI DOCUMENTS

Laser

Laser Hardening, EPRI CMF TechApplication, Vol 1, No 18, 1987

Laser Cutting, EPRI CMF TechCommentary, Vol 3, No 9, 1986

Laser Cutting of Metal, EPRI CMF TechApplication, Vol 1, No 6, 1987

Laser Cutting & Scribing of Ceramics, EPRI CMF TechApplication, Vol 1, No 5, 1987

*Most of the above references are copyrighted and are available from the
Electric Power Research Institute at a nominal cost.
Call 1-800-432-0267.*

This information is designed to help you determine **potential** applications for the technology. You are encouraged to contact one of the listed vendors or a consultant for details and pricing.

This manual is not intended as a recommendation of any particular technology, process, or method. Mention of trade names, vendors, or commercial products do not constitute endorsement or recommendation for use. It is offered for educational and informational purposes and is advisory only.

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For reprints write to:
TVA Economic Development
400 West Summit Hill Drive
Knoxville, TN 37902-1499



E-Mail:
sjhillenbrand@tva.gov

Developed with funding from the U.S. Environmental Protection Agency - Center for Environmental Research Information